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Chapter 6

C-0 Outfitting

6.1 Introduction

Several years ago, in 1998, the basic structure for full utilization of an interaction region at C-0, at the time called a "test hall," was constructed. A collision hall large enough to contain a two-arm version of BTeV was excavated. The shell of building large enough to contain a staging area and a counting room was constructed. We now need to put the finishing touches on this infrastructure in order to support both the BTeV detector and the new interaction region that will be installed in the Tevatron. For the BTeV detector, we need to provide the building substructures including a mezzanine, heating, ventilation, air condition, plumbing and electrical power. The interaction region requires a high voltage power upgrade, some architectural modifications, air conditioning and other power.

The full C-0 Outfitting Conceptual Design Report is available at http://www-btev.fnal.gov/review/temple04/index.shtml . Here we give only a brief description. The footprints of the essential elements of this subproject on the Fermilab site are shown in Fig. 6.1.

The site work involves upgrades of the existing C-0 Test Area Building constructed in 1998 to install the power and mechanical services required to support the BTeV project. Upgrades to the area include paving of the existing hardstand parking lot, construction of a new staging area hardstand and repaving of the existing entrance road to the building. The existing utility corridor maintenance road will also be extended to the entrance road and paved. Underground utility work involves the construction of a new 13.8 KV feeder duct bank from the existing manhole at the B-4 Service Building to a new transformer pad at the C-0 Building. The transformer pad will contain three new 1500 KVA transformers and a 250 KVA Diesel Generator. Included in the electrical work will be the construction of a new bus duct enclosure from the C-0 Service Building to the Collision Hall, the installation of a new 1500 KVA transformer at the C-0 Service building and two new 750 KVA transformers at service buildings B-4 and C-1.

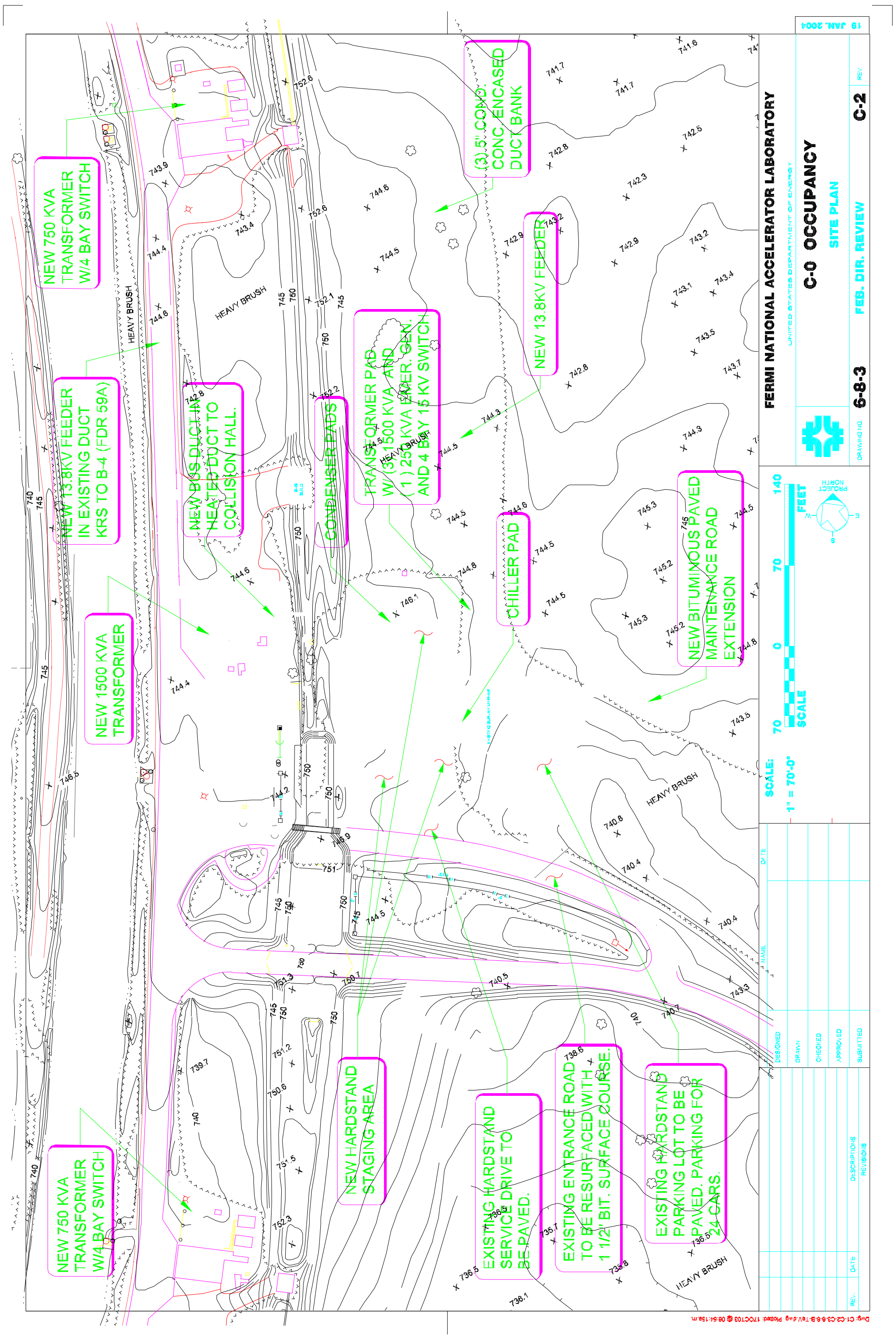

Figure 6.1: Layout of different buildings and components associated with the C-0 site.

6.2 Required Outfitting for the BTeV Detector and C-0 Interaction Region

6.2.1 C-0 Building Modifications

The 5-level C0 building will house a 3-story counting facility for the BTeV detector and limited office space. Most BTeV members will have offices in the High Rise (Wilson Hall).

To complete the outfitting of the C-0 building, we need to install walls, doors, finishes, stairs, an elevator, and a raised computer floor for one of the counting room levels. Once the concrete floors have been installed to provide new floor levels at elevations 755'-4" and 764'-2", concrete block walls will be constructed between the high bay area and each of the newly installed floor sections on the north side of the building. Each of the 3 floors will have windows installed between the newly occupied space and the existing high bay. These windows will allow in daylight from the existing high bay skylights to enter the new areas, thereby enhancing the quality of the spaces, and allowing occupants to view the activities below. Fig. 6.2 shows a slice through the building showing the staging area used for assembling parts of the BTeV detector before moving to the interaction region. Fig. 6.3 shows the slice through the building showing the interaction region denoted here with the original label of "test hall."

Concrete block walls and hollow metal doors will be installed to enclose the equipment room, the elevator shaft, the stairway, the toilet rooms and janitor closets, as well as the mechanical and equipment rooms at elevations 731'-4" and 715'-0". An elevator will be installed in the existing shaft space. The elevator will be a 5,000-pound capacity "hospital" type elevator with openings on either end as required to accommodate the floor plan, with a total of 5 stops. Slight modifications will be made to the roof above the elevator shaft, raising it to a height that will provide the required head clearance for the elevator access to the third floor. An enclosed exterior stair will be construction on the north side of the building, to provide the code required second means of egress for the first, second and third floors. It will consist of steel framing with siding and roofing to match the existing building. The current stairways provide the required exits from below grade spaces.

The entrance level (first floor) of the building (elev 746'-6") will have a raised computer floor system installed over the already constructed depressed floor. Also constructed on this floor will be the interior stairs, the stair enclosure and the wall for the electrical equipment room and elevator enclosure, as well as the wall separating this floor from the high bay. Similar to the first floor, the second floor of the building (elev 755'-4") will see the construction of the interior stairs, the stair enclosure walls, and the wall closing off this floor from the high bay. In addition, this floor will house the new single user men's and women's toilet rooms, the janitor closet and a small kitchenette to service the building occupants. The third floor (elev 766'-0") will have a raised computer floor system installed over the newly installed concrete floor construction. Constructed on this floor will be the interior stairs, the stair enclosure wall, the elevator enclosure walls, and the wall closing off this floor from the high bay.

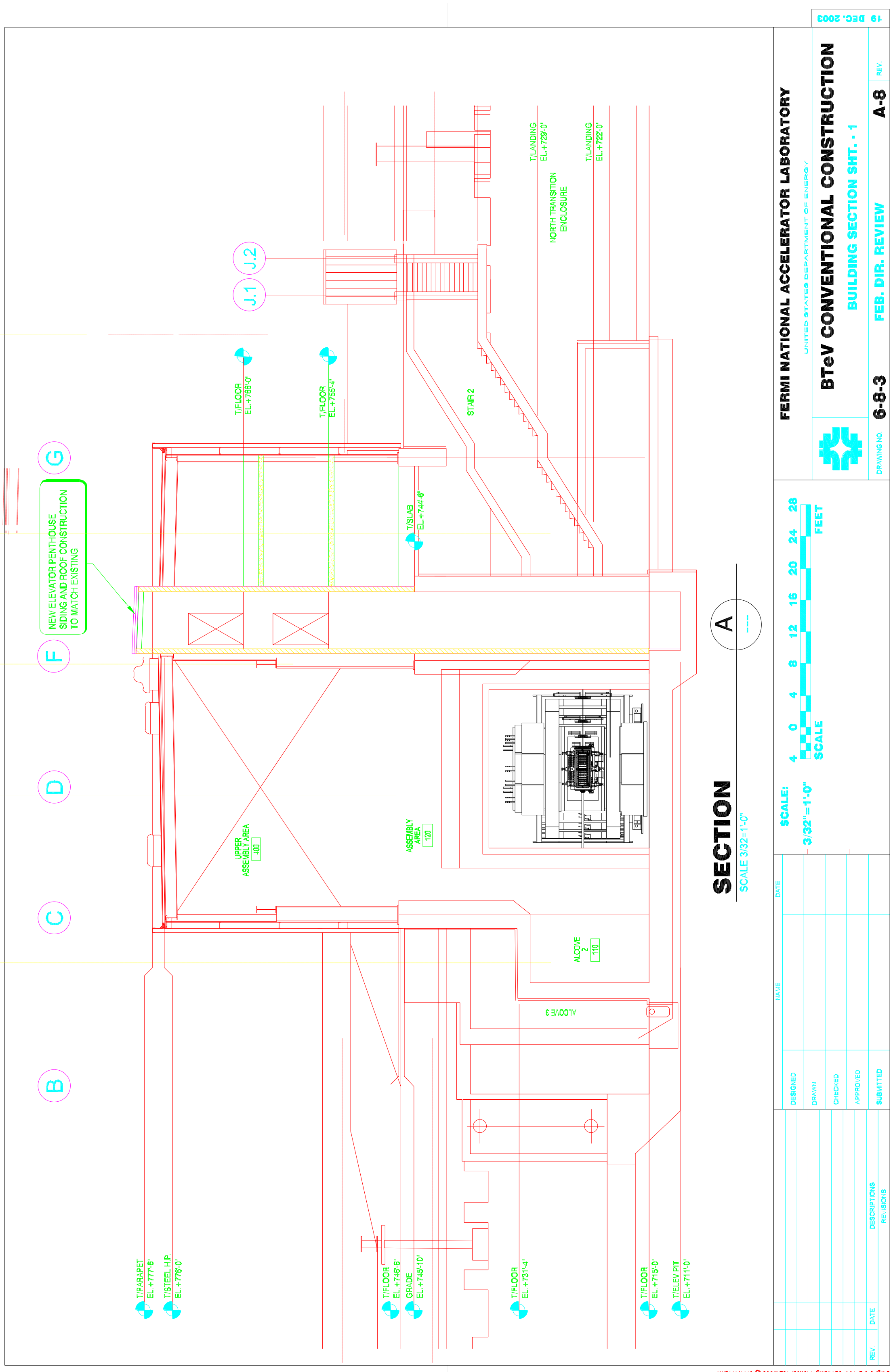

Figure 6.2: Section through C-0 Hall showing staging area.

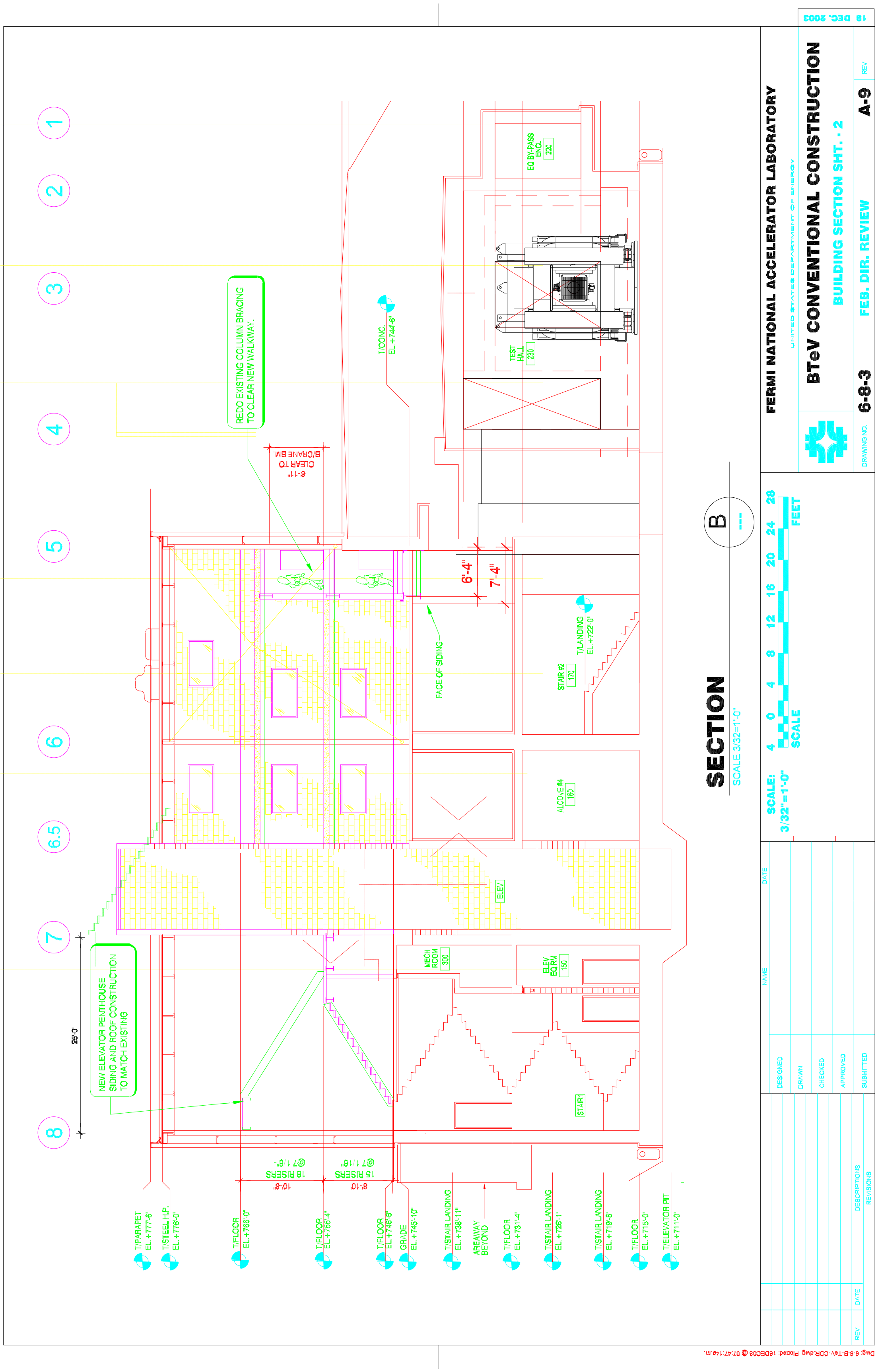

Figure 6.3: Section through C-0 Hall showing interaction region.

The wall finishes will consist of painted or glazed concrete block for the new block walls. The ceiling finish will consist of the exposed underside of the concrete deck, painted with a textured, acoustical material to improve the acoustical qualities of the room. The interior liner panel of the exterior siding will provide wall finishes along the exterior walls. The second floor will have carpeting. The first and third floor computer rooms will have stringer type computer flooring. The computer floors will be isolated to building ground with a separate under floor ground grid tied to the primary transformer grounding loop. The toilet rooms, janitor closet and kitchenette will have ceramic tile floors. All other areas (corridors, stairs, mechanical and equipment rooms) will have sealed exposed concrete floors.

The new floor levels at elevations 755'-4" and 764'-2" are eight-inch thick post tensioned, prestressed concrete floor slabs that have been selected to provide a minimum floor thickness. The slab will simple span between steel beams framed into the existing steel columns. Final design will evaluate cost and construction benefits of the precast slab system vs. a cast-in-place post tension flat plate floor system.

BTeV equipment heat loads will be cooled by various systems as follows.

- 3rd floor will contain high density computing racks that have an approximately 480KW heat load. This unit and space will be cooled by five to seven nominal 30-ton Computer Room Air Handler Units (CRAH), each discharging into a common under floor plenum. Each CRAH will have corresponding outdoor air-cooled condenser with R22 refrigerant. There will be a raised floor air distribution system. The layout of the racks will utilize the "hot-aisle cold-aisle" concept commonly used in present day high-density data center.

- The 2nd floor office area will be served by a dedicated chill water air-handling unit located at the mechanical room. Air from this unit (estimated at 5 tons) will be distributed to this area via an insulated duct work system to be routed to the office area through the pipe/duct chase. This unit will utilize an economizer cycle to cool the space when outdoor air temperatures are appropriate. Minimum outdoor air for 25 persons will be included in the air handling unit design.

- The 1st floor computer area, the collision hall fan coils and various water-cooled components at the staging/hall area (172KW) will be served by a closed loop "electronic cooling water system" (ECW). The temperature to this loop will be controlled at the mechanical room via a heat exchanger/control valve arrangement.

- There will be approximately two 20-ton air handler-chilled-water coil-systems at the mechanical room that will serve the collision hall and the assembly area equipment load as well as building loads. These units will utilize an economizer cycle to cool the space when outdoor air temperatures are appropriate. The catwalk area will be served with two DX split AC unit. There will be three 50-ton water chillers inside the mechanical room with outdoor condensing unit that will provide chilled water to the air handler and the ECW heat exchanger.

- Approximately 97% of the magnet loads (647 KW) in the collision hall will be cooled by the main ring Low Conductivity Water system (LCW). A 4" stainless steel LCW piping will be routed to the collision and assembly hall to pick up this load. The LCW system and all piping will be designed and installed under the IR section of the project.

- The air handlers in the mechanical room will be outfitted and will be integrated with site DDC controls BAS. Air handler will be provided with electric heating coil. The high bay will make use of the existing electric space heater. There will be condensate drains to be provided for the 1st floor and 3rd floor-cooling unit. The mechanical floor will be rework to include floor drains.

Currently the existing C-0 Test Hall has a complete addressable fire alarm system monitoring the entire facility and can be extended to monitor the new fire alarm points. In addition, an existing FIRUS system is installed which signal any fire alarm to our on-site Communications Center, so that emergency personnel can be dispatched.

The fire protection system has the following elements:

- Collision Hall: Provide a pre-action fire sprinkler system connected to the existing piping network. This system will be designed to provide a minimum of 0.20 gpm per square foot over the most remote 1,950 square feet of sprinkler operation. The pre-action valve will introduce water into the piping network upon loss of air and smoke from an air sampling smoke detection system. In addition, a clean agent fire extinguishing system monitored by air sampling smoke detection and closed circuit cameras can be manual released by the operators or fire department personnel.

- : Assembly Hall: Connect with a new sprinkler riser to the existing overhead wet-type fire sprinkler system. This system is designed to provide a minimum of 0.20 gpm per square foot over the most remote 1,500 square feet of sprinkler operation.

- Mechanical Rooms: Provide a new wet-type fire sprinkler system utilizing quick response sprinklers, designed to a minimum of 0.15 gpm per square foot over the most remote 950 square feet of sprinkler operation.

- Computer/Mezzanine Levels: Provide a new wet-type fire sprinkler system utilizing quick response sprinklers, designed to a minimum of 0.15 gpm square foot over the most remote 950 square feet of sprinkler operation. In addition, a clean agent fire extinguishing system activated by high velocity smoke detection, will be protected the raised computer floors and monitored by an auxiliary releasing fire alarm control panel.

- Gas Shed: Provide (IF NECESSARY) a fixed water spray system protecting the gaseous tanks.

The primary power transformers will be fed from a new 13.8 KV feeder (Fdr 59A) routed through spare ducts in the Main Ring duct back to a new breaker at the Kautz Road Substation (KRS). The majority of this feeder can be installed during normal accelerator operations with some re-racking of the existing feeders in the manholes during a power shutdown. Prior to the installation and energizing of the new Feeder 59A feeder 45 will be connected via a new 4-way air switch at Service Building B-4. The new air switch will be temporarily connected to Feeder 45 using an open bay at the C-4 Service Building air switch. Feeder 45 will allow approximately 2 megawatts of available power prior to the installation of the new dedicated feeder for equipment power testing and building house power and allow for feeder maintenance of the new feeder. Once the new feeder 59A is energized the feeder 45 leg will be removed. A "Y" splice connection to feeder 49 which exists between the Master Substation and D-0 will allow mutual backup of these two feeders. A Kirk key system will be provided to protect feeder 59A and feeder 49 from being interconnected without disconnection of one of the feeders at KRS or the MSS. One 1500 KVA transformer is dedicated to the detector's magnet, the torrid and the compensation magnets. One 1500 KVA transformer will supply quite power for electronics and computers. And a third 1500KVA transformer will supply house power. All three transformers will be loaded to well over 50

6.2.2 Upgrades required for the Interaction Region

The C-0 Service Building will be upgraded to provide for the architectural, HVAC modifications and electrical power additions to support the Low Beta power supplies at C-0. The existing service building consists of office space, shops and data rooms. An interior wall between an existing data room and shop will be relocated to expand the size of the shop to accommodate new power supplies for the Low Beta System. HVAC modifications include the addition of exhaust fans and exterior wall louvers to cool the power supply room. A new 1500 KVA transformer will be installed outside the C-0 Service Building to support the Low Beta System. The transformer will be connected to the power supplies by underground duct bank through the exterior wall of the service building. The transformer shall be fed from the existing pulse power feeder 23 located in the Main Ring Road duct bank. A new 2000 ampere switchboard will be installed. Also fed from feeder 23 are new 750 KVA transformers at Service Buildings B-4 and C-1 that will feed 1200 AMP switchboards. Air switches will be installed to transition from 750 MCM to 350 MCM cable. Other than the power upgrades at B-4 and C-1, no other work in the buildings is anticipated.

6.3 Requirements and Assessments

The subproject will follow all safeguards and security procedures of the Laboratory. Energy conservation features will be incorporated in the design whenever feasible. Health and safety will be ensured meeting the NFPA 101 Life safety codes for egress. Quality assurance will be by following the Fermilab Institutional Quality Assurance Program currently under final development.